COMMUTER FEEDBACK:

AN IMPORTANT ASPECT OF ONGOING ITS DEPLOYMENTS

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Abstract

Throughout the 90's the nation as a whole has been witnessing significant activities in the area of ITS. It began with research and development, early deployment planning (EDP), field operational tests, and continued on with the National ITS Architecture and standards development. Currently, the national ITS program is focusing on "main-streaming" ITS through the Model Deployment Initiative (MDI) and incentive funding for deployment. While this momentum of ITS deployment is encouraging, it is imperative that we attach greater emphasis on determining level of acceptance of these technologies by commuters/travelers. Feedback from commuters should play a vital role in shaping the forthcoming national ITS programs.

In Orlando, Florida, a commuter survey was undertaken to not only assess the effectiveness of the I-4 Surveillance and Motorist Information System (SMIS) project completed in 1995, but also other planned Advanced Traffic Information Systems (ATIS) technologies. Funded as part of the Orlando EDP project, a telephone survey of tri-county (Orange, Seminole, Osceola) commuters was undertaken in 1996. The survey consisted of variety of questions related to trip habits of commuters, reaction to changeable message sign (CMS) displays, decisions to divert under congested conditions, sources of traffic information, and willingness to pay for traffic information.

A statistical analysis of 400 responses from the tri-county area provided interesting results. A majority of the respondents (51%) confirmed that traffic reports broadcast from local radio stations is the most important source even when compared against cable TV and a (hypothetical) Internet web site. The information displayed on CMSs along Interstate 4 was considered reasonably accurate (67%) and timely (58%). About 40% to 50% of the travelers on I-4 would divert to an alternate route if a CMS indicates a delay estimated to be about 10-15 minutes long. If commuters hear that the alternate route is also congested, over 40% would stay on I-4 even if the delay is expected to be 20 or more minutes.

This paper presents much needed survey results comprising of commuter travel habits and perception of ATIS technologies. Results will be valuable to decision-makers involved with selecting ITS projects for deployment.

Acknowledgement

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Introduction

National ITS initiatives began with research and development by federal and state governments, and continued on with field operational tests where various technologies were tested in cities across the nation. Thereafter, Early Deployment Planning (EDP) studies were initiated to assure that major metropolitan cities develop a comprehensive ITS master plan based on regional needs and priorities. A National ITS Architecture was developed to encourage various regions and cities to adopt a compatible architecture. ITS standards and protocols are being finalized which will help ensure communication and data compatibility among products manufactured by various vendors. A current focus of the national ITS program, the Model Deployment Initiative (MDI), was launched in 1996 to showcase a fully integrated ITS operation in few of the major metropolitan cities.

ITS deployments will continue into the future, therefore, it is imperative that we assess how well the technologies are being accepted by commuters/travelers. End user feedback is a necessary input for the success of ongoing ITS programs. While significant effort has been made to determine ITS benefits and market penetration of technologies, it is still not enough. Realizing this need, a study was conducted in Orlando, Florida, to evaluate travel habits of commuters and levels of acceptance of ITS technologies. Particularly, the study focused on acceptance of existing changeable message signs (CMS), designed as part of the Interstate-4 Surveillance and Motorist Information System (I-4 SMIS) and perception of existing and planned Advanced Traveler Information Systems (ATIS) technologies.

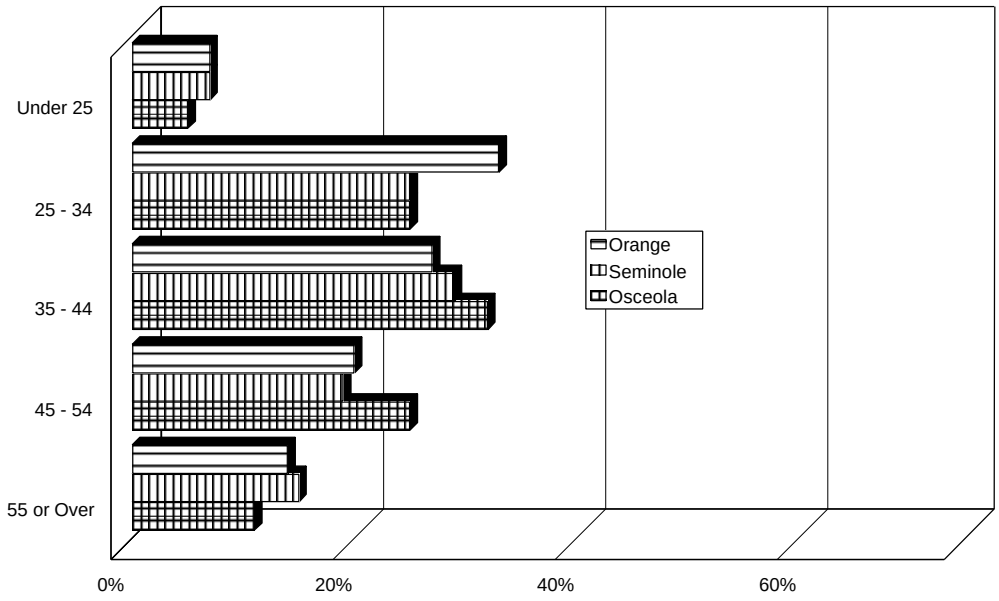
The 1996 commuter survey was funded by the Orlando Early Deployment Study, being conducted by PB Farradyne Inc. under contract to the Florida Department of Transportation (FDOT). Information on commuter travel habits peculiar to Orlando area such as travel time and distance to work, roadway usage, perception of congestion, preferred travel information, and typical working days were summarized. The second part of the survey summarized, in the order of importance, the factors affecting the decision to divert from freeway such as type of congestion, anticipated delay, location of exits, and weather conditions. The effectiveness of various sources of traffic information including radio, CMS, TV, newspaper, and other sources was also included.

A telephone survey of Orlando area residents (Orange, Osceola and Seminole counties) was undertaken with questions geared towards the following objectives:

- Determine the type(s) of travel information important to people especially to commuters, and business travelers (needs of tourists were evaluated in a separate study by FDOT). Evaluate the level of need for traffic information and various sources of information.
- Evaluate the effectiveness of the existing CMSs on I-4, especially understanding and usefulness of the CMS messages.
- Evaluate accuracy, timeliness, and frequency of traffic information displayed on the CMSs.
- Determine the percentage of travelers likely to divert to city streets in reaction to a CMS message. That is, correlate projected delay time to a decision to divert to an alternate route.
- Determine the acceptance of CMSs and ATIS in general. Is there a willingness to pay for this type of traffic information?

Respondent Demographics

It was anticipated that the majority of respondents who commute to work outside their home would be of age 25 to 54 and this assumption held true with 77% falling within this range. Figure 1 shows age of respondents and percentages in each class.



Note: Might not sum to 100% because of refusals

Figure 1
Age of Respondents by County

Gender was monitored to assure approximately half-male and half-female respondents. The final gender split was 52% and 48% for male and female, respectively. Two-thirds of the respondents were married and 26% were single. The largest socioeconomic grouping (24%) had a 1995 household income of at least $50,000 with 20% between $20,000 and $29,999.

Survey results indicate that there is a perception of “marked increase” in traffic congestion in the Orlando area for their trip to and from work over the past year. This observation could be attributed to the current or recent construction activities on I-4 and other major surface arterials throughout the area. Commuters aged 55 and over plus commuters who travel at least 20 or more minutes to work were most likely to report an in congestion. These findings are shown in Table 1.

Table 1
Perception of Increase in Congestion During Work Trip

	COUNTY[a]			Total
	ORANGE	SEMINOLE	OSCEOLA	
	%	%	%	%
INCREASED SIGNIFICANTLY	29%	41%	38%	35%
INCREASED SOMEWHAT	29%	24%	33%	28%
ABOUT THE SAME	35%	26%	26%	30%
DECREASED SOMEWHAT	4%	7%	1%	4%
DECREASED SIGNIFICANTLY	2%	1%	1%	1%
DNK/NO COMMENT	3%	2%	1%	2%

a. Note: Columns might not sum to 100% due to rounding or refusals

Typically, commuters travel at least 9 miles one way (64%) to work with 40% of the respondents driving over 12 miles to work. Osceola County residents clearly travel further to work than residents in any other counties in the survey area. Table 2 shows typical travel distance to and from work.

Table 2
Travel Distance to Work

	COUNTY[a]			Total
	ORANGE	SEMINOLE	OSCEOLA	
	%	%	%	%
UNDER 1 MILE	2%	1%	1%	1%
1 - 2 MILES	5%	8%	10%	7%
3 - 4 MILES	9%	8%	5%	8%
5 - 8 MILES	22%	19%	12%	18%
9 - 12 MILES	24%	29%	19%	24%
OVER 12 MILES	37%	33%	53%	40%
DNK	1%	3%	0%	1%

a. Note: Columns might not sum to 100% due to rounding or refusals

As expected, the majority of respondents work between two and five days per week (78%) with another 20% working over five days of the week and males work more days than females (27% and 13%, respectively), as shown in Table 3.

Table 3
Typical Work Days

	COUNTY[a]			Total
	ORANGE	SEMINOLE	OSCEOLA	
	%	%	%	%
LESS THAN 2 TIMES PER WEEK	1%	3%	0%	1%
2 - 5	78%	83%	74%	78%
MORE THAN 5	21%	14%	26%	20%

a. Note: Columns might not sum to 100% due to rounding or refusals

Most (56%) get to work between 6:00 am and 8:00 am while 24% arrive between 8:00 am and 10:00 am. Significantly more (62%) of the early arrivals have a 20+ minute commute to work. The average commute time is 26.4 minutes (median 20.4 minutes). This compares to 21.8 minutes for the Florida state average (1990 Census) and 22.9 minutes for the Orlando metropolitan area. The travel time comparisons by county are as follows:

- Seminole County residents: 30.1 minutes mean, 20.5 minutes median—tend to use I-4, US 17-92, and SR 436;
- Osceola County residents: 25.9 minutes mean, 22.5 minutes median—tend to use US 192, back roads and side streets; and
- Orange County residents: 24.2 minutes mean, 20.3 minutes median—tend to use I-4, back roads, side streets, and SR 436.

Traffic Diversion Characteristics

All respondents who work outside their home were asked if certain factors have an affect on the decision to divert from their planned route to work when congestion is encountered. It is clearly evident that the congestion circumstances are the most influential. When asked to pick the factor that has the most influence, 29% of responses relate to the "type of congestion encountered" or "the estimated delay time" (12%) as shown in Table 4.

Table 4
Factors Affecting Diversion

	Factor's Effect:		
Factor	***A Lot***	***Somewhat***	***Little/None***
The type of congestion encountered	33%	28%	38%
The estimated delay time based on the information you have available	30%	25%	43%
Whether or not there is an exit between the point of congestion and your current location	30%	21%	46%
The time you leave for work	21%	19%	58%
Your current day's calendar, particularly early morning events	17%	16%	66%
The weather	13%	11%	76%

NOTE: Row responses might not sum to 100% due to rounding and/or refusals.

Traffic Information

The majority of respondents listen to radio station traffic reports as opposed other traffic information sources/types[1] during their commute to work. Due to the similarity of results, it is anticipated that many respondents consider "road signs along the route" to be synonymous to the "CMSs along their route" thus giving this category a very high level of importance. Another finding was the "value" placed on the City's metro traffic reports. While 21% find them very important, fully half say they are of limited importance. Significantly more Orange County respondents (58%) find them more important than respondents from either Seminole or Osceola County (45% and 34%, respectively). Long duration commuters with 20+ minutes

[1] Not all information types/sources are currently available in the area.

travel time to work seem to rely on them more with 52% finding them at least somewhat important as shown in Table 5.

Table 5
Importance of Traffic Information

	Importance		
Source/Type of Information	***Very***	***Somewhat***	***Little/ None***
Radio station traffic reports	51%	24%	25%
Road signs along your route to work	33%	33%	35%
The traffic information signs along your route	32%	30%	37%
An in-car city map system with access to traffic information to display on screen	25%	13%	62%
TV station traffic reports	22%	23%	55%
An in-car information terminal that has access to traffic information	22%	16%	61%
The city's metro traffic reports	21%	27%	49%
Traffic information from a family member/friend	19%	32%	48%
A *xxx cellular phone number	13%	14%	73%
Radio station 'hot line'- a special number to call for traffic reports	11%	18%	70%
City maps	11%	11%	78%
Newspaper articles	8%	22%	70%
A two-way pager type device that can send/receive information	8%	14%	78%
CB radio reports/conversations during your commute	7%	9%	83%
TV 'hot line'- a special number you can call for traffic information	7%	14%	79%
Cellular telephone conversations	8%	14%	79%
Bus schedules	5%	5%	90%
Car pool information line	2%	8%	89%

NOTE: Row responses may not sum to 100% due to rounding and/or refusals.

Although responses across each county have no statistically meaningful difference, results are, nevertheless, interesting:

- Radio station reports are of less importance to Osceola County respondents than other County respondents.
- Carpool information is somewhat important to Orange and Osceola County respondents.
- Metro Traffic reports are less important to Osceola respondents and more so to those living in Orange County.
- An in-car electronic map and navigation system has more appeal to respondents from Orange County.

Real Time Traffic Information

The survey found that the perceived importance of real time traffic information is limited. Even though 13% would find it "extremely important" and another 28% "very important," 33% rate its availability as of "limited importance." A significant number of respondents do say it would be "somewhat" important or they are "unsure" (37%).

These results indicate that most travelers are not willing to pay for traffic information. Of those offering an amount (69% of the total respondents) 67% say they would not pay for real-time information. About 17% would pay at least $10 a month and another 15% would pay something less than $10 a month. Orange and Seminole County respondents are the most willing to pay (19% would pay $10 or more) and commuters from Osceola County the least (77% would not pay anything).

Interstate-4 Changeable Message Signs

As an integral part of the I-4 SMIS, there are 22 CMSs spaced over 39 miles of the interstate through Orlando. These CMSs have been operational since 1995 – at least 12 months before the survey was conducted. Three out of four (73%) respondents have noticed the signs, and one in four have not. Those who had not noticed the CMSs are primarily from Osceola County (46%), female respondents (31%), and those who typically commute under 20 minutes (34%).

Commuters who had noticed the signs find the information useful (70%) and reasonably accurate (67%). Only 15% say the information is not accurate and another 18% are unsure. While just over half (58%) find the CMSs to be timely, 23% say it is not, and 19% don't know or are unsure. Significantly more respondents who live in Orange County find the signs useful (76%), accurate (74%), and timely (64%). Seminole County respondents are the least likely group to describe the information as favorable. Osceola residents are more critical of the accuracy of the information displayed.

The survey found that congestion related information might affect a commuter's decision to divert to an alternate route. The type congestion information that respondents feel should be displayed on CMSs are listed in Table 6.

Table 6
Type Information Displays Desired on CMS

Information	Response (%)
The type of congestion/situation	52
The estimated delay time	50
Distance to actual congestion point	34
Exits available to congestion point	23
Lane blocked/closed	18
Side street information	8

NOTE: Multiple responses allowed

Message formats that include standard abbreviations were not perceived as a problem (95%). There was a marginal need for a variety of languages (29%) on the message signs, but this

was to be expected since the survey did not specifically target tourists. FDOT is conducting a separate study aimed at tourist traveler information needs.

A large majority (67%) said that the CMS should be installed on all major state roadways. A significant minority (39%) would favor a "reasonable tax" to offset the cost of installation of these signs.

Route Diversion, Commute Time, and Reported Congestion

A key element of this survey was the determination of a linkage between the messages displayed on the CMS and driver reactions. This knowledge will allow operators to estimate the likely impact of placing a particular message on a CMS and therefore allow for a quicker response to these impacts. For example, FDOT has a policy of estimating the delay time due to incidents or congestion and putting this information in the CMS message. The question then is what kind of diversion to surface streets can be expected for various levels of delay estimates displayed to the drivers.

In addition to a variation in the amount of delay reported, it was anticipated that a driver's average travel time to work would have an effect on their decision to divert off the freeway. The survey accounted for this by changing the question slightly based on previous responses regarding travel time to work.

A scenario was presented to each respondent that asked their likelihood of diverting to an alternate route given the fact that the CMS was displaying a delay ahead (this was varied) and that they were within some range of reaching their desired destination (this was also varied). The scenarios were arranged so that all respondents, regardless of their average travel time, faced a decision between diverting or staying on the freeway and thereby accepting travel time delays between 3 minutes and up to double their average commute time.

Table 7 presents the results of the responses to these scenarios. The results of this survey indicates that 40% to 50% of drivers, for any given scenario would divert from I-4 if the estimated (CMS displayed) delay is 10 to 15 minutes long. Female commuters whose travel time is 20 minutes or longer are more tolerant than males and would not divert until the delay estimate was slightly longer.

Table 7
Traffic Delay and Diversion Characteristics

Traffic Information Sign displays a ...		Travel Time to Work [a]		
		Under 10 minutes	10 - 19	20 +
DELAY TIME 5 - 10 MINUTES, DIVERT TIME	3 MIN	15%		
	5 MIN	15%		
	10 MIN	27%		
	15 MIN	8%		
	20 MIN	19%		
	30 MIN +	12%		
DELAY TIME 10 - 20 MINUTES, DIVERT TIME	3 MIN		7%	
	5 MIN		10%	
	10 MIN		27%	
	15 MIN		22%	
	20 MIN		18%	
	30 MIN +		17%	
DELAY TIME 20 - 30 MINUTES, DIVERT TIME	3 MIN			7%
	5 MIN			4%
	10 MIN			27%
	15 MIN			29%
	20 MIN			16%
	30 MIN +			16%

a. NOTE: Column sums might not add to 100% due to rounding or refusals

Once the data is displayed graphically, it clearly shows the “10 to 15 minute spike” denoting the most probable diversion point across the three scenarios. For commuters with 20+ minute travel time to work and home based workers with 20-30 minute delay range, a vast majority will divert if the estimated delay is 10 to 15 minutes.

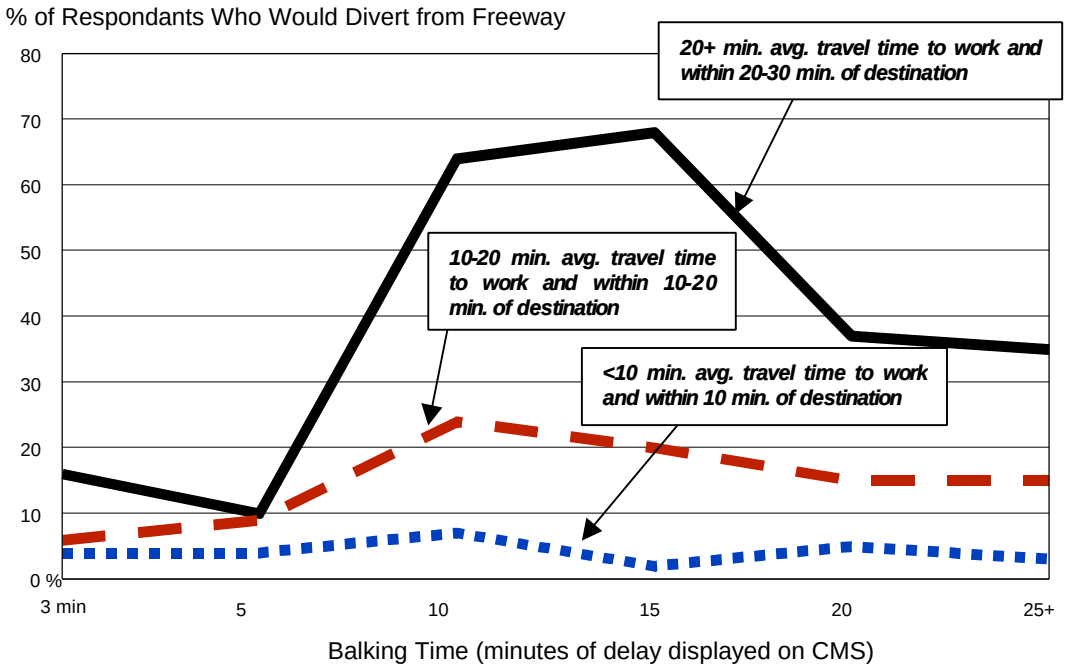


Figure 2
Relationship Between Delay Time and Diversion

The diversion time estimates are further corroborated by studying the interrelationship between travel time to work and the results of each respective scenario using Pearson's Correlation coefficient. The result of this statistical test is shown in Table 8 and its significance on each commuter group and scenario is described below.

Table 8
Pearson's Correlation

Parameter	5-10 Minute Delay	10 20 Minute Delay	20 30 Minute Delay
Travel Time to Work (in Minutes, 1-way)	0.112	-0.110	-0.141*

NOTE: '*' denotes 2-tail statistical significance of 0.014.

Commute Time Under 10 Minutes
Respondents with a commute time under 10 minutes confronted with a 5 to 10 minute congestion delay indicate that they would wait to divert up to the 30+ minute level. This is because of the "direct" relationship between Travel Time to Work and a 5 to 10 minute delay time as denoted by the positive correlation coefficient. However, the relationship is not statistically significant. Table 7 shows that roughly 30% will wait at least 20 minutes but 42% will take the exit if a 5-10 minute delay is expected.

Commute Time 10 - 20 Minutes
Commuters with a 10 to 20 minute commute period, appear unwilling to wait given the higher delay estimate displays. This confirmed by the negative correlation coefficient. In this case there is an indirect relationship, but statistically not significant. While one-third will wait 20+ minutes before diverting, almost half will take the earlier exit if the delay is between 10 and 15 minutes.

Commute Time 30+ minutes
The statistical significance and an indirect relationship confirms that this group will avoid a prolonged wait. Within this commuting time class, 32% will wait 20+ minutes while 56% will take the exit if the delay is 10-15 minutes.

As an addition to the above hypothetical scenario, the respondents were asked: "if a radio traffic report says that the alternate route is also congested what actions if any will you resort to in terms of diversion." While some would still take the earlier exit, over 40% would stay on I-4 and wait even if the delay is expected to be 20+ minutes. Results are shown in Table 9 and graphically in Figure 3.

The results of this second scenario are not surprising. More drivers would remain on the congested freeway given knowledge of congestion on alternate routes. This result argues strongly for a comprehensive approach to traveler information.

Table 9
Traffic Delay and Diversion Characteristics With Congested Alternative Route

Just heard a radio report that the alternate route is also congested, the Traffic Information Sign displays a ...		Travel Time to Work [a]		
		Under 10 minutes	10 - 19	20 +
DELAY TIME 5 - 10 MINUTES, DIVERT TIME	3 MIN	12%		
	5 MIN	4%		
	10 MIN	23%		
	15 MIN	4%		
	20 MIN	12%		
	30 MIN +	35%		
DELAY TIME 10 - 20 MINUTES, DIVERT TIME	3 MIN		4%	
	5 MIN		4%	
	10 MIN		10%	
	15 MIN		14%	
	20 MIN		14%	
	30 MIN +		43%	
DELAY TIME 20 - 30 MINUTES, DIVERT TIME	3 MIN			5%
	5 MIN			3%
	10 MIN			11%
	15 MIN			17%
	20 MIN			21%
	30 MIN +			35%

a. NOTE: Column sums might not add to 100% due to rounding or refusals

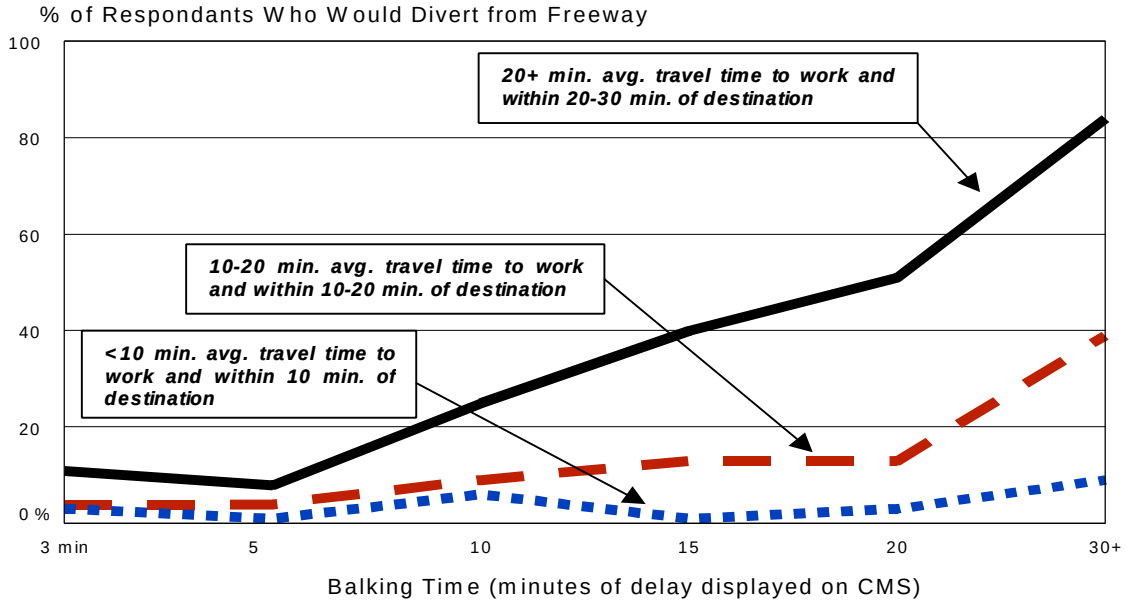


Figure 3
Relationship Between Delay Time and Diversion With Alternate Routes Congested

Conclusion

The survey of the Orlando commuters provided a wealth of information on travel habits, diversion decision making, source of travel information, and perception of ITS technologies. This information was used in the Orlando Early Deployment Planning study to help guide ITS deployment priorities. For example, freeway and expressway traffic management was a very high ITS priority for FDOT and other Orlando area transportation agencies. The results of this survey reinforced the importance of traveler information through a system of changeable message signs – a key component of Advanced Traffic Management Systems (ATMS). This, in turn, should lead to quick public acceptance of these types of ITS projects.

This survey also provided a tool for estimating and predicting the secondary impacts of congestion on freeways and expressways. By knowing at what level of delay (as displayed on the message signs) drivers will divert to alternate routes, more effective traffic management schemes can be developed for the network as a whole – surface arterials as well as freeways and expressways.